DOCUMENT RESUME

ED 452 839 IR 020 679

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TITLE Renaissance 2000.
PUB DATE 2000-09-00
NOTE 18p.; In: The Secretary's Conference on Educational Technology, 2000: Measuring Impacts and Shaping the Future. [Proceedings] (Alexandria, VA, September 11-12, 2000); see IR 020 668.
AVAILABLE FROM For full text: http://www.ed.gov/Technology/techconf/2000/. For full text: http://www.ed.gov/Technology/techconf/2000/presentations.html.
PUB TYPE Opinion Papers (120) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Change; Communications; Developing Nations; *Economic Development; Educational Development; Educational Technology; Foreign Countries; Information Skills; *Information Technology; Internet; *Technological Advancement
IDENTIFIERS *Technological Change

ABSTRACT

This impact paper discusses the nature of emerging technologies and markets at the turn of the millennium. The first section considers the impact of the printing press on the Renaissance. The second section considers implications for Renaissance 2000 (R2K), triggered by a new mode of communication, i.e., the Internet. The third section addresses the shift from "push" to "pull" in how informational media operate, emphasizing that individuals will need a different set of skills to actively seek out information. The fourth section describes a dual economic structure in which the economy of atoms (physical goods) is marked by the law of diminishing returns, while that of bits is marked by the law of increasing returns. The fifth section examines the downward pressure on the prices of most high-tech goods and the problem that this presents for manufacturers; the shift toward an experience economy as a solution is discussed. The sixth section looks at the accomplishments and failures of desktop computers. The seventh section presents the concept of "shift control" (i.e., a shift in control to the consumer) as a dominant force for R2K that will reach into virtually all transactions. The eighth section addresses education in R2K, and the last section covers R2K in the developing world. (MES)

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Renaissance 2000

By: David D. Thornburg

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Renaissance 2000

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Winter, 2000

The view from the edge...

The edge of the millennium makes a good vantage point for thinking about the future in terms of the past. Like standing on a mountain ridge where the view is unobscured in all directions, it is exciting to be poised on the cusp of time with the opportunity to take the long view. Of course, in the case where time is our horizon, the view is less than clear. Even so, when viewed in terms of epochs instead of years, broad patterns emerge that might lie hidden when we focus on the short term perspective encouraged by the incredibly fast pace of life that has been the focus of the past few years.

From this historical perspective, I am convinced we are at the dawn of a new renaissance -- Renaissance 2000, or R2K -- a renaissance that, like the first one, will have a tremendous impact on all aspects of our lives from education to

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business. As with the earlier renaissance, this one will be triggered by a communications revolution. Unlike the previous renaissance, this one will reach hundreds of millions of people scattered throughout the far reaches of the globe.

That was then...

A little over 500 years ago, the European explorer Columbus "discovered" the New World. We attribute the discovery of the Americas to Columbus, even though we now have evidence that Viking explorers had found our continent about 500 years before. So why do we celebrate Columbus and not the earlier explorers? Why didn't the Vikings trigger an age of exploration and discovery? These questions have complex answers, but one factor that might be of great relevance is that, in the period between the two series of discoveries, the moveable-type press became available in Europe. The printing press allowed books and tracts to be mass produced at low cost for the first time in history. This meant that news of the explorers' journeys could be spread quickly over large distances, triggering excitement in those who could find ways to prosper with this information, or whose creativity was triggered by the discovery of lands to the West. In the absence of the press, news of the Nordic exploits were hidden, and the capacity of these discoveries to trigger creativity in the population of Europe were limited. As Paul Levinson points out in his book *The Soft Edge*:

> Socially, technologically, scientifically, the Europe of 1000 AD was in no condition to embark upon an epoch of discovery and settlement across the Atlantic. But part of the reason also lies in the way that word of the Norse discoveries must have reached people back in Europe, if it reached them at all. Couched in oral sagas, whispered in the cold winds, the words had no endurance. (p26)

There is little question that within the first fifty years of Gutenberg's first Bible, the press was starting to have a major impact on the flow of information. In 1493, for example, an eight-page pamphlet describing Columbus' exploits became a best seller, with editions appearing in Rome, Paris, Basel, Antwerp, Florence, Germany and Spain. The appearance of this document in several languages helped its popularity. The concreteness of the printed form gave substance to its words, and nations reacted. England sent Cabot to the new world in 1497, and the Portuguese funded Cabral's discovery of Brazil in 1500.

This impact of a medium of communication on the creation of an age is reflected in the thoughts of Levinson and others: "Read All About It! The

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Press Discovers America!"

In fact, the informational technology of the printing press was still at an early stage when Columbus made his journey. But with the publication of the complete works of Virgil in Italian by Aldus Manutius in 1501, the stage for an explosion in information was well set. The appearance of the classics in inexpensive bound volumes triggered the creativity of an age. It is as though the rise in access to information led directly to a rise in creativity. While it is true that the Renaissance had its share of brilliant thinkers, there is little reason to doubt that equally brilliant minds could be found at any period in history. It was the capacity to bring audiences to these minds that made their contributions noteworthy. When we think of the Italian masters, for example, names like Leonardo, Michelangelo, Rafael and others dominate our thinking. But without the communications climate that supported the creativity of these (and numerous other) masters, their work might well have been hidden from view. The flowering of science and art that we associate with the Renaissance was as much a product of the new medium of communication as of anything else.

This is now...

So what does this imply for us at the dawn of R2K? As with the first Renaissance, this one is triggered by a new mode of communication -- one as powerful as print, and one with powers that print never had: the internet (and, in particular, the World Wide Web).

The era just ending has gone by several names: the Information Age, and the Communication Age, to name just two. (One term that captures the essence of our current use of technology is "telematics," a word used outside the United States to describe the combined effect of computing with telecommunications.) The focus during this period was on the growth of access to information through electronic media that, unlike radio and television, were under the control of the user, not the broadcaster. Even the vaunted power of the press pales in comparison with the capabilities of this new medium. Media of the past were purely informational. The Web is both informational and interactive. Furthermore, virtually anyone with the tools needed to access the Web can also become an author. The barrier to publishing has been eradicated with this new medium, giving rise to the voice of millions of authors, artists, musicians, scientists, poets and philosophers who can now share their insights with a potentially vast audience. The democratization of publishing has tempered the need for

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patrons. While the artists and scientists of the Renaissance needed (or at least appreciated) the financial support of well-heeled patrons, the barrier to communication of creative ideas has been reduced significantly.

While it is true that the Web has yet to reach into every home, it is the fastest growing communications technology in history, reaching 50 million users in only four years. Even by the height of the Renaissance, books (and literacy) had yet to reach the kind of penetration and scope the Web achieved in a fraction of the time. And, unlike printing in the 1500's, today's communication revolution is a truly global phenomenon.

From push to pull...

Prior to the Web, most informational media operated by "pushing" their content at the user. Newspapers yelled their top stories through bold headlines. Radio and television were under the total control of the broadcasters who determined how, what, and when information was to be delivered. The highly edited nature of these media had good and bad points. On the plus side, the average citizen was freed from the task of deciding what information was relevant to know. Information flow was top-down, and we trusted experts to keep us informed. The downside of this equation is that news stories that failed to capture the excitement of an editor went unreported, even if there was an audience for whom these stories were relevant.

Today users of the Web have access to information in myriad forms -- both edited, and unedited. Those who want a perspective vetted by the New York Times are free to get their news online from that source. Those who wish to read the raw wire feeds have this capability, and those interested in first-person accounts of incidents can find these unedited nuggets on-line as well.

Because the Web deals with bits instead of atoms, the physical cost of printing is removed as a barrier to reaching a wide audience. But more than that, the Web differs from earlier informational media in that it allows the users to "pull" the information from disparate sources, rather than having the information "pushed" to them by a traditional information provider.

The shift from push to pull is tremendously significant. It shifts some burdens from publishers to readers. If you are going to actively seek out information of interest, you need a different set of skills than those associated

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with a world in which information is pushed. In particular, you need to know how to locate information, how to determine if what you have located is relevant, and how to determine if it is accurate. These foundational skills were less important in a world where information was edited and pushed to users.

From atoms to bits...

Intellectual property in R2K can be made available for little cost through postings on the internet. While the creative works of the Renaissance were frozen in physical form (paintings, sculptures, buildings, books), much of today's creative offerings exist purely in the world of diaphanous bits. By separating the bits from the atoms, a dual economic structure results. The economy of atoms -- of physical goods -- is marked by the law of diminishing returns, while that of bits is marked by the law of increasing returns.

Understanding this principle affords companies the chance to split their bit-based and atom-based operations into separate divisions, or at least to understand that these two aspects of a company need to be treated differently. One good example of this can be found with American Airlines (more accurately, its parent company AMR Corp.) In 1996 AMR sold 18% of its computer reservations system (SABRE) to the public, holding on to the rest. This provided a tangible value to an informational asset. Interestingly, the remaining 82% of SABRE accounts for roughly 50% of AMR's value. In other words, one of the largest airlines in the world, with 700 jets, 100,000 employees, and exclusive landing rights in some of the world's most popular airports is worth about the same as its computer reservation system. The value of the computer system is that it can be leveraged in a way tangible assets can not. A single plane can only be used on one route at a time, but the reservation system can be used by millions of people simultaneously. The physical assets are "rival" assets -- they can only be used for one purpose at a time. Knowledge assets aren't rivals. In fact, the more they are used, the larger the return. The larger the network of users, the greater the benefit to everyone. This aspect of increasing returns leads to lock-in in the marketplace, giving tremendous power to those who establish leadership first.

With zero incremental cost of manufacturing, bit-based products can practically be given away, especially in the early phases of product development. This insures rapid market penetration and the building of name recognition that can sustain a company once it becomes well

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established. This was the approach taken by Netscape when Navigator was first released. By giving away their Web client, Netscape not only rapidly built a large user base, it forced Microsoft to give its client away in order to build a niche for itself in the same market. Without price as a competitive factor, product features become a driving force for product selection. The result was a typical example of a "Red Queen," (from Lewis Carroll's character who had to run as fast as possible just to stand still.) The competition between Netscape and Microsoft was so intense that lesser-known browser manufacturers largely fell by the wayside, leaving the market to these two companies.

All of this suggests that a key for survival in R2K is "get big fast," and there is merit in this admonition. In the absence of venture capital, though, this advice is hard to follow. This means that businesses wishing to thrive in the new millennium may need to find other strategies for success.

From commodities to experiences...

In the midst of the longest sustained economic boom in U. S. history, the downward pressure on the prices of most high-tech goods is phenomenal. Part of this can be attributed to the continued impact of Moore's Law as the complexity of silicon-based devices doubles every 18 months with a concomitant drop in cost. Most computer users are aware that the $1,500 machine on their desks outperforms multi-million dollar mainframes made a decade or so ago. But, beyond the inexorable force of Moore's Law lies another force that is bringing added pressure for lower prices. Computers have become commodities. Customers increasingly see computers as largely interchangeable boxes, any one of which will meet their needs for word processing, internet access, etc. Furthermore, customers realize that their investment will be obsolete with a year or two, and are increasingly reluctant to invest heavily in something that will be eclipsed by better technology (at the same or lower cost) in a short time.

This downward pressure on price is driven by the large number of new users who are purchasing computers for the first time. Attracted by low prices, these customers are being enticed to invest in technology. Even if their investment fails to live up to the hype, the cost is sufficiently low that large numbers of people are getting "wired," just in case. All of this is great if you are a customer. For well under $1,000, you can purchase a computer whose power would have been unimaginable at any price a few decades ago. But if you are a computer manufacturer, the picture is not so rosy. Computers obey

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the economic laws of atoms, not bits. Diminishing returns apply, and the downward price pressure of commoditization is driving much of the profit out of many companies.

Fortunately there is a solution to this problem. If you think about commodities, goods, and services, there is typically a profit premium that can be added as you move up the chain. Unfortunately, (as we've seen with computers) goods are being turned into commodities, and the same pressure will be applied to many services as well. Fortunately, as Joseph Pine and James Gilmore have pointed out in their book, *The Experience Economy*, there is another category to add to our list that resists commoditization: *experiences*. Experiences are at the top of the profit chain because they address the personalized human dimension of a product offering and because they make the customer feel special.

While the experience economy can be seen as an extension of the service economy, the underlying ideas can be applied to the goods sector as well. As mentioned above, the computer industry has experienced tremendous downward price pressure as computers are increasingly being perceived as commodities. The problem this presents for manufacturers is that the profits are being driven out of their companies. An alternative approach has been taken by several companies who have used industrial design and marketing as a strategy for turning computers into experiences. Compaq, for example, has chosen to play in several markets simultaneously. In addition to their line of inexpensive "beige box" computers, Compaq has introduced their Presario 3500 series of desktop computers that are stunning in appearance. First and foremost, these computers are state of the art in technical performance. But, beyond that, they are attractive to look at. The Compaq M300 notebook computer looks strikingly different from traditional laptop computers, and purchasers of these computers are buying into a different experience as computer users. Through their preference for elegant designs, they are communicating their interest in being apart from the pack.

Apple has based its recovery on the idea that its customers "think different." This ad campaign coupled with new Macintosh computers packaged in brightly colored cabinets has raised the interest in and profits of this company. The Palm V personal digital assistant introduced by 3Com has an industrial design that is extremely sensual yet highly functional. The ad campaign for this device implies that users of the Palm V will have a different experience than those using other PDA's (including other models made by Palm).

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Numerous other examples can be found of high-tech devices that have avoided the trend toward commoditization by providing customers with experiences -- experiences for which customers will gladly pay.

The creativity of R2K will become evident in the ways that companies of all kinds shift themselves into the experience economy. Sometimes, it will be a matter of industrial design that captures that market's imagination (and money), and other times it will be the creation of a whole new category of product or service that will drive sales. No matter which approach is taken, creativity takes a front seat in the new economy. "Me too" products will find their way to market, but the public has already made it clear that these products need to be priced very low to capture any sales. This represents a bifurcation point in the R2K marketplace. Low priced generic products will reflect the continued pressure toward commoditization on the one hand, while higher margin products that afford astounding user experiences will experience growth as well. Elegance, functionality, and quality will have a growing place in the economy, and the creative outpouring of R2K will contribute to this movement. Companies that make the shift to the experience economy will maintain high margins and do well. Those that take a back seat and compete on price will find their margins evaporating. Current size and past sales history will be of little comfort to those who fail to grasp the essential elements of the new economy.

From desktops to personal information appliances...

The personal computer has grown in popularity to become the dominant appliance of the past two decades. Computer penetration into homes has grown exponentially to reach the point where most homes in the United States have a desktop computer in them, and many of these machines are connected to the internet. Many have written about the personal computer "revolution" and its impact on business, entertainment and education. At the dawn of R2K, it is important to acknowledge what the desktop computer accomplished, as well as what it has failed to do.

First, let's look at the accomplishments. Prior to the late 1970's, computers were large devices found in special rooms in corporations, banks, and government agencies. They were seen as massive "electronic brains" that were poised to influence virtually every aspect of our lives. They were perceived as being outside the understanding of most people, and their role was often categorized as that of an emotionless dictator whose errors caused untold human grief. Even programmers and mainframe computer users saw

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themselves as being in the service of these machines. The 80-column punched card was the one link most people had with the otherwise invisible machines. The admonition to not "fold, spindle, or mutilate," was found on punched cards, and also on the t-shirts of those who felt they were in danger of enslavement by these machines.

While personal computer kits had been on the market for a few years, the release of the Commodore PET, Apple II, and Radio Shack TRS-80 in the late 1970's triggered the start of a mass market for personal computers. These (comparatively) small devices started showing up in the homes of hobbyists and other technology enthusiasts who, initially, had to create most of their own programs using BASIC. While Visicalc catapulted the Apple II into businesses, most corporations relied on mainframe or mini-computers for their data processing needs. The personal computer was seen as a problem for businesses since it decentralized computing and made life hard for system administrators. The fight against personal computers in corporations continued even after IBM belatedly entered the market with their own PC. In time, the advantage of having a computer on your desk started to outweigh the advantage of a large centralized computer under the control of a priesthood of systems analysts, and sales of personal computers in corporate settings mushroomed.

As desktop computers grew in popularity, computers became demystified. Rather than being seen as faceless dictators, computers were now seen as tools for empowerment. Given the popularity of computers today, it is hard to believe that many once feared these machines.

The main problem with desktop computers is that we call them "personal computers," when they are about as personal as a brick. While we no longer have to go to a special room to use them, we still need to be where the computer is, rather than have the computer with us. There are two reasons for this: First, the physical size and weight of these devices argues against portability. Second, they are tied to our desks with two cords -- one for power, and one for networking. For this reason, today's desktop computers are personal in name only.

But just as the desktop (largely) replaced the mainframe, the rise of truly portable information appliances will replace today's desktop computers for many users. And, just as power flowed to the user with the move from the mainframe to the desktop, so this flow will continue as the true personal computer comes into existence. Today's laptop computers represent a

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transitional technology on a continuum that includes a variety of devices ranging from Web cell phones to PDA's such as the Compaq Aero or Palm Pilot.

The personal computers of R2K will have two characteristics: battery operation, and wireless networking. Freed from the physical constraints of weight, and power and communication wiring, these devices will be with us whenever we want them, and will provide virtually anywhere/anytime access to the infosphere. These devices will probably not attempt to serve as tools for every conceivable need, but will be highly customized in function. We might carry multiple devices with us, each tailored to a specific need, and each capable of sharing information with our other devices, as well as with any desktop computers we still might be using. At least initially, these portable devices largely will be devoted to access and presentation of information, with desktop systems still being used some for authoring and the creation of new work.

Another way of thinking about this shift to personal information appliances is that, in the days of the mainframe, many people were served by one computer. The desktop computer brought the ratio to 1:1. The personal information appliances of R2K will bring multiple computers into the service of each individual -- a complete reversal of the old paradigm.

What will these new devices look like? Some will resemble current devices like the Palm Pilot. Others may just be built into key chains, like the Factoid device designed at Compaq's Western Research Laboratory. This key chain-sized device has the capacity to exchange information with similar devices. It has no buttons, no display, no microphone, and no speaker. Its only I/O device is a 900 MHz transceiver with a range of 30 feet. How would this device be used? Imagine attending a conference and, each time you shake hands with someone, their business card data is transferred to your Factoid, and your information is sent to the other person. When you get back to your office, your Factoid will automatically update your contact manager. The entire process is automatic. Because this PDA has no display or keyboard, there is no user interface to deal with. It operates by itself in the background. As long as these devices can share information with each other and with our other computer systems, there is little question that these devices will proliferate.

For those devices that need to communicate directly with us, earpieces and retinal projection displays can reduce much of the bulk associated with

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computer output devices. While speech recognition still has a long way to go, we are approaching the time when speaker-dependent automatic speech recognition is good enough for many tasks, thus eliminating the need for a keyboard. For a prototype of this form of PDA, look at the cell phones that use inconspicuous headsets. For certain types of information retrieval, a cell phone connected to Portico or MyTalk can already replace some tasks that used to require a computer connected to the Web.

Shift Control...

One of the greatest changes that will bloom during R2K can be expressed in two words found on any computer keyboard: Shift Control. There is a shift in control taking place on many fronts, all facilitated by the technologies of the past fifty years. Because (through the Web) the general public now has access to information that was only available to restricted audiences, people are taking control of their transactions in many powerful ways. Medical doctors have observed that many of their patients are asking more intelligent questions about their treatment based on research done using the plethora of medical information sites on the Web. Car dealers are finding that customers know exactly what the dealer margin is, and are able to drive harder bargains than ever before. Traditional stock brokerage houses are losing customers not just because on-line brokers are cheaper, but because research on stocks can be conducted over the Web for free.

When Francis Bacon said, "Knowledge is power," he meant that the power was held by those who kept the knowledge to themselves. In his essay on Empire he wrote: "And certain it is, that nothing destroyeth authority so much as the unequal and untimely interchange of power pressed too far, and relaxed too much." In the past, consumers had less information than suppliers, and hence had less power in negotiations. Today control has shifted, and successful companies are taking advantage of this phenomenon. Customers are seen not just as consumers, but as producers as well. For example, customers at Amazon.com are allowed to write and post reviews of books they have read, making them contributors to the Amazon site. Software companies commonly make early releases of their software available for free so potential customers can evaluate the features and make recommendations that will improve the final product. Everyone wins in this environment.

Contrast this model of business with the one found in the pre-internet world. Companies created products that were then pushed through the sales channel

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by advertising, pricing, and some measure of luck. Customer involvement in product specification was either non-existent or was limited to small focus groups that were convened to fine tune products once they were fairly far along. The information revolution that preceded R2K set the stage for the rise of the "prosumer," the customer who also influences the production of the item being purchased. Sometimes this relationship appears in the form of mass-customization, (as with Dell, Cisco and other on-line technology vendors). Sometimes it shows up as disintermediation (as with stock brokerage houses or car dealerships), and other times it shows up when a vendor forms an affinity relationship with customers by providing them with a forum for expressing their ideas and sharing them with other customers (as with Amazon).

Whatever form it takes, "shift control" is a dominant force for R2K and it will reach into virtually all transactions.

Education in R2K...

Educational systems have generally mirrored the societies in which they were developed. The shift from the scribal to typographic era, for example, meant that educators' role changed markedly. In the scribal era, lecturers were hired for their capacity to read clearly so students could transcribe their own books directly from the lectures. Once textbooks were mass-produced, the role of educators changed to being content experts who could use the text as one tool to help students achieve mastery in a subject. More recently, education underwent another revolution in response to the needs of the Industrial age. Concepts borrowed from industry and mass-production were mirrored in classrooms as schools restructured around the idea of fixed-length periods, bells, students clustered by age, and subjects taught as if they were piecework. The rise of Taylorism in industry was reflected in the desire of schools to measure student performance through standardized tests.

The impact of this transformation was so strong that it remained virtually intact during the shift from the Industrial to the Information Age. Rather than result in a wholesale transformation of education, the tools of the Information Age were used to improve the productivity of the Industrial Age classrooms without taking advantage of the opportunity to completely overhaul the educational system in response to a new societal paradigm. In retrospect this is not surprising, since society at large was not transformed by the fruits of the Information era until fairly recently. Large corporations generally incorporated the new tools into their old business practices and,

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until recently, did fairly well. It is only with the rapid growth of the Internet that we have seen the world of large existing corporations threatened with oblivion. So, in fact, our educational system has mirrored the world outside classrooms until fairly recently. But, just as corporations are scrambling to reinvent themselves in the face of the information explosion, the shift in control, and the other factors mentioned above, schools will reinvent themselves as well.

The opportunity for schools in R2K is profound. Just as the original Renaissance was about information and creativity, so will this one be. The mark of an educated person during the Renaissance was his or her capacity to think intelligently about a wide range of topics. Beyond that, Renaissance thinkers were creative people, not just those who memorized a large number of disconnected facts. They also thought in terms of projects, not in terms of isolated tasks. The holistic approach to learning in the Renaissance takes on new power during R2K, and forms a foundation for a complete overhaul of educational practice in our schools today.

Fortunately, we have some excellent models in place to launch us into this new era. Chief among them is project-based learning in which mastery of subjects takes place in an interdisciplinary setting while students are engaged in a large project. Examples can be found in both the private and public sector. For example, the Mars Millennium Project co-sponsored by NASA, The U. S. Department of Education, and others, provides a complete interdisciplinary curriculum the cuts across numerous traditional subject area boundaries (science, math, social studies, music, art, etc.) as students engage in a long-term project to design a sustainable community on Mars for the year 2030. Classroom Connect, through its "quests," makes excellent use of the Web as a tool for in-depth interdisciplinary explorations of research projects in which students interact with professionals in the field.

Thus far, the largest long-term project-based learning activity in the world was probably the Brazilian History project lead by ARS in Recife, Brazil. This project (to be completed in 2000) involves up to 15,000 students throughout the country who are spending five years studying Brazilian history (one century per year) through a telematic-based multidisciplinary project that includes field trips during the winter break to historical sites. Students conduct interviews, visit historical locations, create Web sites based on their findings, and post corrections to errors they find in the current history textbooks. Students take part in historical re-enactments and spend an incredible amount of time on their projects. The key to the success of this, or

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any other project-based learning activity, is that it engages student interest. Because project-based learning involves long-term commitment to an activity, it is essential that the underlying topic be engaging to student interests.

The net result of the shift to a project-based curriculum is the death of education as "trivial pursuit." The day may soon come when we look at reruns of Jeopardy and laugh at the idea that we ever thought that intelligence was related to one's capacity to memorize decontextualized tidbits of information.

The beauty of a project-based curriculum is that learning is contextual, and therefore more likely to be retained. While standardized tests will be around for awhile longer, practitioners of a project-based curriculum need not fear for their students. Their performance on tests driven by the Industrial Age paradigm should be just as good as ever, if not better. Of course, new contextual assessments will be developed, probably incorporating peer review of completed projects.

As project-based learning becomes the norm, it will start to have an impact on the transformation of schools from rooms full of students to the creation of learning communities in which teachers and students alike explore domains of inquiry in depth with a balance of information and creativity. The role of technology in this setting can be profound, especially as compact telematic tools become commonplace. Learners and educators will have instant access to informational resources throughout the world. Classrooms will be defined by the presence of learners, not by the rigid structure of schools. Clicks and mortar will co-exist -- learning is a social phenomenon, and communities of learners need to congregate. But they also will have access to informational resources scattered throughout the solar system. In this regard, the impact of R2K on education is likely to be greater than that of the first Renaissance.

Most importantly, students will engage their minds fully in the educational process, not only gaining mastery of the information they need, but exercising their creativity in ways that keep open the doors for lifelong learning.

R2K in the developing world...

As we make the shift to the creative era associated with R2K, global power shifts can emerge. While it is true that the developed world has a strong lead

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in broadband telecommunications, it is also the case that much of the developing world is catching up quickly. A few years ago the Internet backbone for Brazil operated at 10 megabits/sec. Today electric utilities, TV cable operators and telephone companies are racing to bring broadband services to a wide audience at low cost. By 1999 residential customers in Recife, for example, could get broadband (2 Mb/sec) access through fiber optics for about US$20 per month -- a better price than is currently offered in the United States.

The rapid deployment of both fiber and wireless systems is bringing access to the Internet to an ever-increasing audience -- an audience for whom pent-up demand is incredible. Within the next three years, many developing nations will have information access rivaling that of the United States, and some may even approach that offered in Finland -- currently the most-wired country on the planet.

Anyone who has spent time working in the developing world has noticed the tremendous creativity of the people who live there. Because creativity is the currency of R2K, this feature, coupled with the benefits of the telematic revolution, will allow some countries to leapfrog their way into a position of tremendous economic strength. Because of this, anyone who plans to thrive in the coming years should be paying extremely close attention to the developing world, and be prepared to make whatever investments are necessary to take part as R2K becomes a truly global phenomenon.

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